

Claims

What is claimed is:

1. A method of obtaining a desired mixture of at least two substances, the substances being mixed in a proportion, the desired mixture having at least one property that is influenced by the proportion of the substances in the desired mixture, the desired mixture having a desired range for the property, the method comprising the steps of:
 - mixing the substances to form a working mixture;
 - preparing a prototype with the working mixture;
 - measuring the property of the prototype;
 - comparing the property of the prototype with the desired range;
 - calculating an adjustment in the proportion of the substances; and
 - repeating the above steps until the property of the prototype is within the desired range.
2. The method according to claim 1, the property comprising color.
3. The method according to claim 1, the desired mixture comprising at least three substances.
4. The method according to claim 3:
 - the property comprising at least two coordinates;
 - each coordinate being influenced by the proportion of the substances;
 - and
 - the desired range having a desired subrange for each coordinate.

5. The method according to claim 4:

the property comprising color; and

the coordinates being chromaticity coordinates.

6. The method according to claim 1, said calculating comprising using a computer.

7. The method according to claim 6, said calculating comprising using a spreadsheet program.

8. The method according to claim 6:

said calculating comprising dividing the property into component bands;

and

performing calculations on each band.

9. The method according to claim 6, said calculating comprising performing iterative calculations.

10. The method according to claim 9:

the desired range having a target; and

said calculating comprising forcing convergence between the measured property and the target.

11. The method according to claim 1:

said calculating comprising determining quantities of the substances to add to the working mixture;

said repeating the above steps comprising:

adding the quantities to the working mixture, and

mixing the substances to form a slightly different working mixture.

12. The method of claim 11:

the property comprising color;

the coordinates being chromaticity coordinates;

said calculating comprising using:

a personal computer, and

a spreadsheet program; and

the substances being phosphors.

13. A method for determining a proper combination for obtaining a color within a

desired range, the method comprising the steps of:

calculating quantities of sources of color;

combining the sources of color;

preparing a prototype;

measuring the chromaticity of the prototype;

determining if the chromaticity of the prototype is within the desired range; and

repeating the above steps until the chromaticity of the prototype is within the desired range.

14. The method according to claim 13, the prototype comprising at least three sources of color.

15. The method according to claim 13, said calculating comprising using:

a computer; and

a spreadsheet program.

16. The method according to claim 13, the sources of color being phosphors.

17. The method according to claim 16, the prototype being a lamp.

18. The method according to claim 17 further comprising the step of manufacturing liquid crystal displays.

19. The method according to claim 13:

said calculating comprising determining an adjustment of the sources of color; and

said repeating the above steps comprising adding the adjustment to the quantities of sources of color.

20. The method according to claim 19, the sources of color being phosphors.

21. The method according to claim 20 further comprising the step of manufacturing lamps for backlighting in avionics applications.

22. The method according to claim 13, said calculating comprising dividing the chromaticity into component wavelength bands.

23. The method according to claim 22, the wavelength bands each being substantially the same width.

24. The method according to claim 23, the wavelength bands each being:

at least one nanometer wide; and

no more than 3 nanometers wide.

25. The method according to claim 13, said calculating comprising performing iterative calculations.

26. The method according to claim 25:

the desired range having a target; and

said calculating comprising forcing convergence between the measured property and the target.

27. A computer implemented method for determining a proper mixture of phosphors for manufacturing florescent lamps that produce a chromaticity within a desired range, the method comprising the steps of:

calculating the proportion of each phosphor to obtain the desired chromaticity;

mixing the phosphors to form a first working mixture;

preparing a first prototype using the first working mixture;

measuring the chromaticity of the first prototype;

using a computer, calculating a first adjustment in phosphor quantities;

adding the first adjustment in phosphor quantities to the first working mixture to form a second working mixture;

preparing a second prototype using the second working mixture; and

measuring the chromaticity of the second prototype.

28. The method according to claim 27, said calculating comprising:

dividing the relevant spectrum into wavelength bands; and

performing calculations on each wavelength band.

29. The method according to claim 28, the calculations comprising hard coded values specifically for the phosphors being used.

30. The method according to claim 29, said hard coded values having been empirically determined by constructing a single-phosphor lamp with each substantially pure phosphor and measuring the chromaticity of each single phosphor lamp.
31. The method according to claim 27, said calculating comprising performing calculations using tristimulus values.
32. The method according to claim 27, said calculating comprising performing iterative calculations until convergence is achieved.
33. The method according to claim 27 further comprising the steps of:
- using the computer, calculating a second adjustment in phosphor quantities;
 - adding the second adjustment in phosphor quantities to the second working mixture to form a third working mixture;
 - preparing a third prototype using the third working mixture; and
 - measuring the chromaticity of the third prototype.
34. The method according to claim 33, said calculating comprising:
- dividing the relevant spectrum into at least ten wavelength bands and performing calculations on each wavelength band;
 - the calculations comprising hard coded values unique to the phosphors being used;
 - performing calculations using tristimulus values; and
 - performing iterative calculations until convergence is achieved.

35. The method according to claim 33 further comprising the step of manufacturing active matrix liquid crystal displays for avionics applications.

36. The method according to claim 33 further comprising the steps of:

using the computer, calculating a third adjustment in phosphor quantities;

adding the third adjustment in phosphor quantities to the third working mixture to form a fourth working mixture;

preparing a fourth prototype using the fourth working mixture; and

measuring the chromaticity of the fourth prototype.

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